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81-10098 Analyzing and modeling gravity and magnetic anomalies using the SPHERE program and Magsat data

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During the period January, February and March, 1981, progress has been made on several aspects of the research program. However, the lack of Investigator Tapes has precluded direct processing of MAGSAT data.

Progress continues toward resolving questions about reducing anomalies to the pole near the geomagnetic equator. Computer codes have recently been completed, tested and documented for analyzing magnetic anomaly vector components by equivalent point dipole inversion. These codes will be used to invert the magnetic anomaly due to a spherical prism in a horizontal geomagnetic field and recompute the anomaly in a vertical geomagnetic field. The calculations will be tested against exact computations utilizing our spherical earth modeling program SPHERE. A further pole-reduction test will be performed on the spherical prism anomaly computed at low inclinations of the IGS-75 geomagnetic reference field.

Modeling of potential fields at satellite elevations that are derived from three-dimensional sources by program SPHERE has been made significantly more efficient by improving the input routines. The new subroutine allows the random input of body coordinates. From these body coordinates, the source model is gridded for analysis and the latitude and longitude of all boundary and interior points are determined. An additional routine is being prepared to plot plan and perspective views of the original inputted and gridded bodies. A preliminary model of the Andean subduction zone has been used to compute the magnetic anomaly at satellite elevations using both actual geomagnetic parameters and vertical polarization. The magnetic characteristics of the model are being varied to test the possible range of magnetic anomalies and the gravity anomaly from the subduction zone model is being calculated at the earth's surface and satellite elevations.

Program SPHERE also is being used to calculate satellite-level magnetic and gravity anomalies from the Amazon River Aulacogen. Magnetic data from Project Magnet flights over South America have been requested to assist in developing the geologic model and a gravity anomaly map of South America obtained from the U.S. Defense Mapping Agency is also useful in this regard. The Project Magnet data also may be useful as "ground truth" for the satellite magnetic observations.

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The free-air gravity anomaly map of South America obtained from the DMA is being digitized at 1° intervals and combined with 1° quadrilateral means in the adjacent marine areas to obtain a digital data set of our study area. The immediate use of this array will be to compute the gravity anomaly at satellite elevations for comparison with the observed magnetic data.

Processing of the NOO-VMS scalar magnetic data has continued for the purpose of testing the veracity of satellite magnetic data. A contour map of the surface long-wavelength data has been prepared. Preliminary spherical upward continuation of this map shows a strong correlation with POGO and preliminary MAGSAT maps after removal of a long-wavelength component.

In consideration of the GSFC decision to provide the investigator tapes in IBM-compatible format only, we have recently negotiated the use of the IBM 3031 computer at Purdue University's Laboratory for Applications of Remote Sensing (LARS) for processing the MAGSAT data tapes. Our efforts would be facilitated considerably if GSFC could make available for implementation on the LARS system software which reads the investigator tapes in their current formats and 1) permits us to scan and select data geographically and by K_p -indices, and 2) converts the orbital coordinates of the data into geodetic coordinates. Also, we require software and coefficients for 3) modeling an appropriate geomagnetic reference for processing the MAGSAT data. Finally, a program that 4) selects and inverts data directly from the investigator tapes also is requested for implementing on the LARS-system.

Abstracts of papers concerned with this research program have been prepared and submitted to the Spring Annual Meeting of the AGU and the Fourth Scientific Assembly of IAGA which will be held in August, 1981. The papers submitted in abstract form to the AGU are: "Regional Magnetic Model of the Mississippi Embayment" by R.R.B. von Frese, W.J. Hinze and L.W. Braile and "Long Wavelength Aeromagnetic Map of the U.S." by J.L. Sexton, W.J. Hinze, R.R.B. von Frese and L.W. Braile. The papers submitted to IAGA are: "Satellite Elevation Magnetic and Gravity Models of Major South American Plate Tectonic Features" by M.A. Longacre, W.J. Hinze, R.R.B. von Frese, L.W. Braile, E.G. Lidiak and G.R. Keller and "U.S. Aeromagnetic and Satellite Magnetic Anomaly Comparisons" by R.R.B. von Frese, W.J. Hinze, J.L. Sexton and L.W. Braile.